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A5T 505

# (54) MASK FOR ADMINISTERING GAS TO A PATIENT

(71) I, GLENN EDWARD BROWN, a citizen of the United States of America, residing at 24040 Summit Road, Los Gatos, California, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is performed, to be particularly described in and by the following statement:—

This invention relates to a mask for administering gas to a patient and an apparatus incorporating such a mask for administering gas to a patient, for example in a treatment room.

In the administering of anaesthetic gases to patients a mask is placed over the nose or mouth of the patient and a controlled amount of the gas is permitted to flow into the mask.

In apparatus used previously a substantial amount of the gas either escaped or was emptied into the room in which the patient is located. Approximately five to ten litres of gas are delivered to a patient under anaesthesia or analgesia.

Some of this gas is absorbed into the body of the patient but the excess gas is allowed to escape into the surrounding environment through a pressure relief valve. The gas absorbed into the body during anaesthesia also is exhaled by the patient as soon as the anaesthetic gas flow has been stopped, resulting in virtually all the gas which has been administered to the patient being ultimately dumped into the room.

In prior apparatus, the exhaled gas and the gas fed through the mask which is not inhaled is usually dumped directly into the room surrounding the patient which naturally raises the concentration of such gas in that room each time the anaesthetic process is performed. For instance in a dental surgery the process can be performed many times a day and if the air is not scavenged by passage through a non-recirculating air-conditioning system, the concentration of the gas can become quite high. Such concentrations can reach the level at which the dentist's consciousness and dexterity are actually affected by the continuous breathing of the gas.

A growing concern for the side effects of the escaped gases on the health of the operating personnel has been voiced by many medical groups and committees. The high levels of waste anaethestics present in surgeries or operating theatres today are unnecessary and possibly harmful to the personnel involved. Hospitals have already started to make moves to effectively scavenge the anaesthetic gases in their operating theatres to decrease the levels of gas inspired by their operating personnel. Dental surgeries on the other hand have had fewer regulations and levels that have been found in dental surgeries have been much higher and it is desirable to help the dentist in his efforts to scavenge waste gases in the future and to provide for administering anaesthetic gases in a manner to limit the exposure of the medical personnel to high concentrations of the gas both during the administering process and afterwards.

The present invention provides a mask for administering gas to a patient, comprising an inner cup-shaped shell arranged to fit over the nose or mouth of a patient to engage the face of the patient along the edge of the shell to form a gas chamber between the face of the patient and the inner surface of the inner shell, an outer shell secured to and spaced from the inner shell so as to form an exhaust passage therebetween, the passage communicating with said chamber for receiving exhaust gas exhaled by the patient into the chamber, the edge of the outer shell being adjacent the edge of the inner shell whereby, in use, gas leaking between the edge of the inner shell and the face of the patient flows into the exhaust passage, a gas inlet connected to the inner shell and communicating with the chamber, a gas outlet connected to the outer shell and communicating with the exhaust passage, and a pressure-relief valve connected between the chamber and the exhaust passage.

The inner shell may be formed of a thin flexible material. The outer shell may be cup-shaped and may also be formed of a thin flexible material.

The present invention also provides an apparatus for administering gas to a patient, for example in a treatment room, including the mask of the invention and a gas supply

connected to the gas inlet of the mask and gas removal means connected to the gas outlet of the mask.

Reference is now made to the accompanying drawings wherein:

Figure 1 shows the mask placed on a patient for administering an anaesthetic gas;

Figure 2 is a schematic view of an anaesthetic gas-administering apparatus incorporating the present invention;

Figure 3 is a cross-sectional view of an anaesthetic mask incorporating the present invention; and

Figure 4 is a bottom plan view of the anaesthetic mask of Figure 3.

Figure 1 shows a mask for administering anaesthetic gas to a patient whilst Figure 2 shows schematically the supply and removal of gas to the mask. As in prior apparatus, an anaesthetic gas such as oxygen and nitrous oxide is supplied from a pair of tanks 10 and 11 through shut-off valves 12 and 14, respectively, to a standard mixing valve 15. In the mixing valve the gases are mixed and fed via a supply line 16 into a gas bag 17 for passage through a line 18 to an anaesthetic administering gas mask 19. The overall gas flow rate is controlled at the mixing valve which is of a standard design having flow control means and means for mixing the gases together. The person administering the flow can obtain a visual indication of the breathing volume and breathing rate of the patient by observing the expansion and contraction of the bag 17. In addition, such person can also administer a rapid flow of the gas by squeezing the bag which causes accelerated flow through the line 18 to the mask 19.

The mask 19 is connected to a pump 21 such that gas exhaled by the patient, gas supplied to the mask but not inhaled by the patient, and gas escaping around the mask are collected and pumped to a point exterior of the room by means of the pipe 20, the pump 21 and exhaust pipe 22 leading to a point exterior of the room.

The mask 19 is shown in Figure 3 and comprises an inner mask made up of an inner cup-shaped shell 24 having an opening 25 therein which permits entry of the nose or exit of supplied gases into the mouth. The inner mask has connected thereto a pair of inlet tubes 26 and 27 connecting through lines 28 and 29 to the supply line 18 leading from the anaesthetic bag 17. Thus the gas flows into the gas cavity formed within the inner shell 24 from which it can be inhaled by the patient to whom the gas is being administered. The patient usually breathes through the nose and therefore the mask commonly is placed over the nose; however, if the patient actually breathes through the mouth, either the mask can be placed only over the mouth or the mask can be made of sufficient size to fit over both the nose and the mouth.

The mask is provided with a pressure relief valve 30 (Figure 3) which valve is normally closed by a plunger 31 being spring-loaded over an opening 32 in the inner shell. Thus the gas which enters the inlet lines is contained in the mask and can be readily inhaled by the patient. Upon exhalation by the patient, the pressure within this inner shell is increased sufficiently to cause the plunger to compress the spring 34 to the position wherein the exhaled gas is permitted to pass through the pressure relief valve and into an exhaust passage 35 formed between the inner shell 24 and an outer cup-shaped shell 36 surrounding, but spaced from, the inner shell 24. Connecting with the exhaust passage 35 are a pair of exhaust tubes 37 and 38 in flow relationship with exhaust lines 39 and 40 which join with the exhaust line 20 connecting with the exhaust pump 21.

In a normal mask not using an exhaust pump the exhalation by the patient will cause a substantial increase in the flow of gas into the inner mask such that gas will escape between the edges 25A of the mask and the patient's face. Naturally this leads to a substantial leakage of gas into the surroundings of the patient. However, by using an extract system providing a positive exhaust flow by use of the pump 21 creating a negative pressure within the exhaust lines 20, 39, and 40, the gas is scavenged from the mask to thereby limit leakage through the opening 25A and the patient's face.

The exhaust passage 35 opens adjacent to the face of the patient at a continuous port 35A surrounding the edge 25A of the inner mask. Thus by the creation of a negative pressure and because the edge 31A of the outer shell extends past the edge 25A of the inner shell so as to press more tightly against the patient's face, any gas leaking between the juncture of the inner shell and the patient's face is immediately scavenged through the port 35A to the passsage 35 and into the exhaust lines.

With the creation of a negative pressure between the inner and outer shells there exists the possibility that the mask will become pressed sufficiently close to the patient's face such that it will stick to the face because of the negative pressure within the passage 35 and the atmospheric pressure outside the mask. To counteract this possibility means may be provided to limit the negative pressure within the passage 35. One form of such means involves the location of relief holes 45 in the outer shell 36 connecting the passage 35 with the atmosphere. Such relief holes are not large enough to permit total relief of the vacuum pressure within the passage 35 but do permit sufficient air flow to limit such vacuum pressure.

Of course an actual pressure relief valve can also be utilized if necessary, which valve would control closely the vacuum pressure maintained within the passage 35.

The mask can also be provided with straps or strap attachments 41 for attachment of the mask to the head of the patient. In addition, the pressure-relief valve 30 can be made adjustable by the incorporation of a control knob 42 which is threaded into the outer shell 36. By turning the central knob 42 the tension on the spring 34 can be increased to permit a higher build-up of pressure within the inner shell 24 prior to the opening of the valve. Such a higher buildup might be desirable to cause a quick flow of oxygen to the patient for medical purposes such as revival. Said valve also permits the administration of the gas to control the fullness of the gas cavity and the breathing reservoir.

In addition, the mask may be manufactured from material which is transparent. Such a transparent mask enables the administering personnel to visually observe the proper placement of the mask over the patient's nose and mouth. Also the transparent mask can be inspected easily to detect the presence of any foreign objects or dirt.

WHAT I CLAIM IS:—

1. A mask for administering gas to a patient, comprising an inner cup-shaped shell arranged to fit over the nose or mouth of a patient to engage the face of the patient along the edge of the shell to form a gas chamber between the face of the patient and the inner surface of the inner shell, an outer shell secured to and spaced from the inner shell so as to form an exhaust passage therebetween, the passage communicating with said chamber for receiving exhaust gas exhaled by the patient into the chamber, the edge of the outer shell being adjacent the edge of the inner shell whereby, in use, gas leaking between the edge of the inner shell and the face of the patient flows into the exhaust passage, a gas inlet connected to the inner shell and communicating with the chamber, a gas outlet connected to the outer shell and communicating with the exhaust passage, and a pressure-relief valve connected between the chamber and the exhaust passage.

2. A mask as claimed in Claim 1, wherein said inner shell is formed of a thin flexible material.

3. A mask as claimed in Claims 1 or 2, wherein said outer shell is cup-shaped and is formed of a thin flexible material.

4. A mask as claimed in any of Claims 1 to 3, wherein the pressure-relief valve is normally closed while gas enters the chamber from the gas inlet into the chamber to be inhaled by the patient, and is opened for exhaled gas to enter the exhaust passage from the chamber when the patient exhales gas.

5. A mask as claimed in Claim 4, wherein the pressure-relief valve includes adjusting means for regulating the pressure required to open the valve.

A mask for administering gas to a patient, substantially as herein described with reference to the accompanying drawing.

7. An apparatus for administering gas to a patient including a mask according to any preceding claim, and also including a gas supply connected to the gas inlet of the mask and gas removal means connected to the gas outlet of the mask.

8. Apparatus according to Claim 7, wherein the gas removal means includes a pump.

9. Apparatus according to Claim 7, wherein the gas removal means creates a negative pressure in the passage to scavenge the gas leaking between the edge of the inner shell and the patient's face and the outer shell of the mask is provided with relief holes therethrough between the exhaust passage and the atmosphere to reduce the tendency of the edge of the inner shell to adhere to the patient's face.

10. Apparatus as claimed in Claim 7 for administering gas to a patient and substantially as herein described and illustrated with reference to the accompanying drawings.

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1516494 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

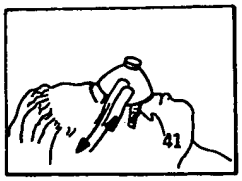


FIGURE 1

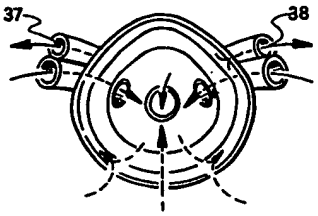


FIGURE 4

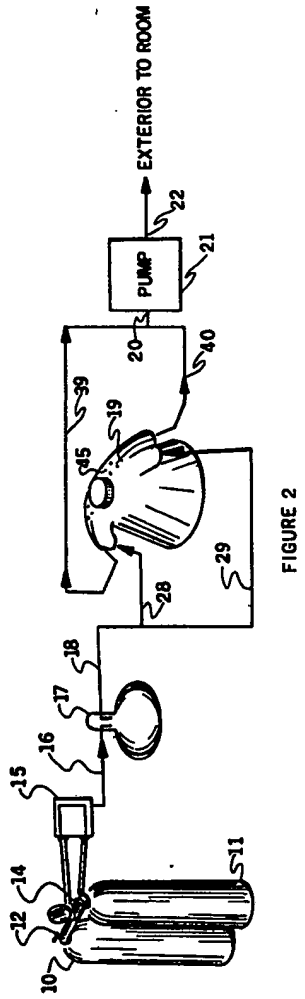


FIGURE 2

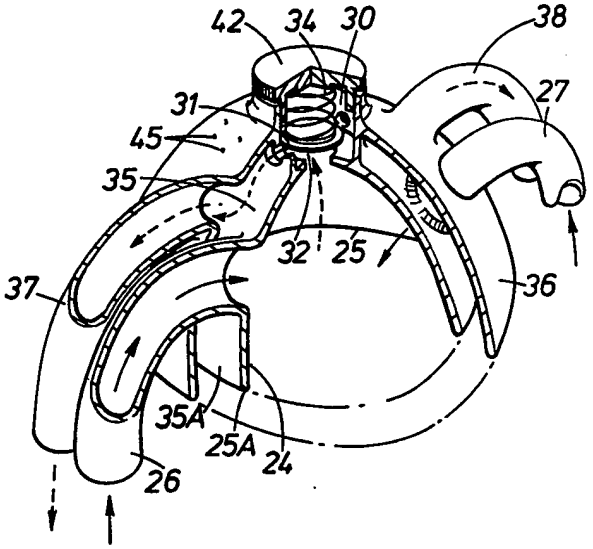


FIG. 3